

DG 2: The relationship between research and practice in mathematics education

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Aims and focus

This DG examined relationships between educational research and professional practice in mathematics education. The call for background papers to stimulate discussion requested analyses of specific cases of work which illuminate interaction between educational/didactical research and professional practice/policy in mathematics education. It was envisaged that, in many cases, this would also involve consideration of the interaction between researchers and practitioners; but equally, cases where the same persons – such as teacher-researchers – fulfil both roles were of interest. The call for papers invited submissions to address several or all of the following questions:

In relation to the case(s) analysed:

- *What were the research and professional motivations for the work described?*
- *What form of interaction between research and professional practice did this work involve, and how was this interaction organised?*
- *How did this work build on existing research knowledge and/or existing professional practice?*
- *How did this work lead to the development of professional practice and/or of research knowledge?*
- *More broadly, through this work, what did researchers learn from practitioners, and practitioners from researchers?*
- *What were important factors affording and constraining this work?*

Considering the case(s) analysed as prototype(s) for wider diffusion:

- *Does work of this type provide models, artefacts, or theories which could be more widely used?*
- *How viable is work of this type as a means of improving professional practice?*
- *What contribution does work of this type make to advancing mathematics education research?'*

Papers for discussion

In response to the call, eight papers were accepted for presentation by distribution, as follows. (These papers were not delivered orally):

Transition of mathematics teaching: Action research in cultural and linguistically diverse classrooms

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* Unable to attend but contributed to shaping the programme of the DG



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Current math reform calls for changes in math teaching and learning (NCTM, 2000). These changes are transitions involving fundamental shifts in reconceptualizing in both mathematical activities and the role of the mathematics teacher (Cooney & Shealy, 1997). Although there have been numerous research projects on mathematics teachers in transition (e.g., Fennema & Nelson, 1997), there has been little research on the connections between mathematics teachers' transition in beliefs and pedagogical content knowledge and the role of teachers' action research on their teaching practice. The notion of teachers' transition has many dimensions. This study only included teachers' beliefs and pedagogical content knowledge in mathematics teaching. The general purpose of this research was to investigate the impacts of mathematics teachers' action research on their transition in beliefs and their pedagogical content knowledge in cultural and linguistically diverse classrooms.

Researcher and teacher in interaction: The graphic calculator in the teaching of mathematics in Denmark

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This article describes a development project where four mathematics teachers co-operated with the author as a researcher. The co-operation process was part of the author's Ph.D.-project. The collaborators worked together on the development of teaching material designed to introduce the concept of Derivative using the Graphic Calculator as a teaching tool. The interactions between researcher and teachers were analysed using a model developed by Ole Skovsmose and Marcelo Borba, and the article also discusses this model. The author generalises from her own experiences both as a teacher and as a researcher and makes a few comments on how research and practice might enhance each other.

The construction of algebraic expressions as context for the interplay between theoretical and practical standpoints

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In this paper the authors approach two main issues as outlined in the DG discussion document, namely "How the interaction between research and professional practice build on existing research knowledge and existing professional practice" and "How did this work lead to the development of professional practice and of research knowledge?" Such questions will be addressed through the discussion of a research study on algebraic thinking, which has been carried out thanks to a close co-operation between university researchers and school teachers. More specifically, we will focus on a teaching experiment, which was carried out in grade 8 (pupils' age: 13-14) and aimed at promoting a functional approach to algebra.

Critical issues in researching cultural aspects of mathematics education

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In this paper the author refers to three significant areas of research which are currently presenting us with equally significant issues – culturally-based mathematical knowledge, hidden cultural values, and culturally situated mathematics learning. More importantly, in the context of this ICME Discussion Group, as the paper is focussed on



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socio-cultural aspects of research in mathematics education, this immediately raises issues about practitioners. Who are they? Clearly not just teachers. There are several other practitioners within the educational field who are also involved – curriculum developers, teacher educators, policy practitioners, school principals etc. But the students are themselves some kind of practitioner, and their parents and the wider community also play roles in this field with their own specific practices. So perhaps this area of research will make us problematise and broaden the oft quoted researcher/practitioner dichotomy.

Putting research into practice: A case in mental computation

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This paper reports on a teaching experiment, conducted in 2003, which aimed at enhancing young students' mental computation performance through incorporating research (the researcher's own and that of others) into classroom practice. Research findings on students' mental computation performance were presented to two Year 3 teachers, along with practical ideas (web sites, readings, etc.) to form a foundation for a short instructional program. The researcher supported the teachers in developing the program, and the teachers took responsibility for implementing the program. This program was developed by the teachers and the researcher. Pre- and post-instruction individual interviews were conducted to monitor student progress and inform the instructional program.

A way of expanding the relationship between researchers and practitioners in mathematics education: The Interlink Network

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The case of the Interlink Network focuses on the interaction between researchers and mathematics teachers from the secondary and middle school (11 to 17 year old students). This network – constituted by teachers, future teachers and researchers – has been operating since 2000 and aims at facilitating the use of information and communication technology (ICT) in the mathematics education developed in some Brazilian public schools. Interlink takes the form of both face-to-face meetings and virtual meetings. In being engaged in a network the teacher may construct knowledge about the use of ICT and act as a result of the collaboration with others. Being an Interlink member has been a stimulus for many participants, in particular for the teachers. The paper points out that Interlink opened possibilities for student, teacher and researcher acting as multiplier. This is a direct interpretation of the idea that many different members could act as a "centre" of the network. This network is a space for personal and professional development.

Linking researching with teaching: Towards synergy of scholarly and craft knowledge

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This paper argues that coupling the creation of scholarly and craft knowledge can contribute to building a more powerful and systematic knowledge-base for teaching. This calls for an approach to knowledge creation in which the distinctive practices of teaching and researching accommodate to one another, through the co-operation of teachers and researchers, or through the co-ordination of teacher and researcher roles by teacher-researchers. The tendency in such collaborations has been to highlight – and privilege



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– the creation of scholarly knowledge within the practice of researching, and its application within the practice of teaching. Yet, not only does the craft knowledge of teachers play an important part in converting scholarly knowledge into actionable form, but there is a significant – though largely tacit – process of knowledge creation within the practice of teaching. Equally, research processes can play a valuable part in eliciting and systematising this craft knowledge of teachers.

***The relationship between research and practice in mathematics education:
Can mathematics education be an evidence-based practice?***

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This paper reports on a project involving classroom-based research activity by a group of primary school teachers in the U.K. The teachers' perspectives on the research process in which they were engaged are reflected on to examine the relationships between research activity, evidence, policy and classroom practice. Scepticism about teaching as an application of evidence-determined policy, in particular the current enthusiasm for educational research modelled on practices in medicine, is set against a model, developed through the work of these teachers, of classroom-based research that is directly focused on practical value in the researching teachers' own classrooms. It is argued that classroom research need not be concerned with generating generalisable findings in order to contribute to improving practice. The paper proposes a conception of research in teaching not as application but as realisation in a local context.

The Discussion Group met on three occasions, breaking down into smaller subgroups to facilitate interactive discussion. The first meeting examined, in a more general way, the issues raised in the call for submissions; while the last meeting was organised as a paper discussion session, allowing participants to join a discussion involving the author(s) of a specific accepted paper. The middle session focused on the work of the ICME Survey Team on 'The relations between research and practice in mathematics education', as reported by Anna Sfard in an earlier plenary lecture.

Few of the participants had read the material made available in advance. Consequently much of the discussion in small groups centred on exchanges about personal situations and experiences, notably about how to improve communication and coordination between different components of the mathematics education system – educational research, teacher education, classroom practice, and systemic policy. Particular reference was made to the value of roles such as teacher-researcher and mentor-teacher which involve teachers in working across two components of the system (classroom practice and educational research or teacher education respectively). The lively discussions exemplified and confirmed the crucial role of co-operation between research and practice in mathematics education. Such co-operation takes many different forms and occurs under very differing circumstances. The examples described in the preliminary reading and accepted papers witness the richness and potential of issues related to the theme. All the papers remain available at www.icme-organisers.dk/dg02/

This report has been written by Kenneth Ruthven and Luciana Bazzini. They are happy to be contacted at kr18@cam.ac.uk and luciana.bazzini@unito.it for further information on the work of this DG.

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